



Original Research Paper

Resource use efficiency of Apiculture and Poultry farming in Kurukshetra district of Haryana.

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Abstract

The present study examined the resource use efficiency of apiculture and poultry farming with the objective of assessing the contribution and efficiency of major production inputs. The resource-use efficiency analysis was carried out using regression analysis, and the marginal value product (MVP) approach was employed to assess the optimal utilization of individual resources. The results revealed that the coefficient of multiple determination (R^2) for apiculture was 0.7553, indicating that 75.53 per cent of the variation in gross returns was explained by the explanatory variables included in the model. Human labour (0.011) and transportation (0.187) had positive and statistically significant effects on gross returns at the 5 and 1 per cent levels, respectively. The regression coefficients of sugar, machine labour and sulphur were positive but non-significant. The MVP values indicated overutilization of human labour and transportation, while machine labour, sugar and sulphur were underutilized, suggesting scope for increasing returns through better allocation of these resources. In poultry farming, the coefficient of multiple determination (R^2) was 0.6304, indicating that 63.04 per cent of the variation in gross returns was explained by the selected explanatory variables. Expenditure on feed or supplements (0.467) was positive and significant at the 5 per cent level, whereas machine labour had a positive but non-significant coefficient. Human labour, veterinary charges, and fuel or electricity showed negative and non-significant coefficients. The MVP analysis indicated overutilization of human labour, veterinary charges, fuel or electricity, and feed or supplements, while machine labour was underutilized. The findings emphasize the need for rational allocation of production resources to improve profitability and resource-use efficiency in both apiculture and poultry farming.

Keywords: Resource Use Efficiency, Apiculture, Poultry Farming, Marginal Value Product (MVP) and Production Inputs.

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Introduction

Apiculture, commonly known as beekeeping, is an important subsidiary agricultural enterprise that involves the scientific rearing and management of honey bees for the production of honey, beeswax and other hive products. In addition to providing direct income to beekeepers, apiculture plays an important ecological role through pollination of agricultural and horticultural crops. It requires relatively little land and can therefore be integrated effectively with crop and horticultural production. Beekeeping also provides opportunities for employment and income diversification, particularly for small and marginal farmers and rural households. At the global level, honey production is widely distributed across Asia, Europe, Africa and the Americas. According to FAO data, China is the world's leading honey-producing country, with about 446,900 tonnes, followed by Türkiye (107,920 tonnes), Argentina (79,468 tonnes), Iran (77,567 tonnes), Ukraine (71,279 tonnes) and the United States (69,104 tonnes).

India produced about 67,442 tonnes of honey, placing it among the major honey-producing countries of the world. In India, apiculture has emerged as an important component of agricultural diversification. The country's diverse agro-climatic conditions, availability of flowering crops, horticultural plantations and forest resources provide considerable potential for commercial beekeeping. Honey production has expanded with the adoption of modern bee colonies and improved management practices. As per the Government of India's estimates, India produced 142.00 thousand tonnes of honey during 2022-23. Major honey-producing states included Uttar Pradesh, Punjab, West Bengal, Bihar and Rajasthan. Haryana has considerable potential for apiculture because of its extensive agricultural area and the availability of flowering crops such as mustard, sunflower, cotton and horticultural crops. The state has increasingly promoted beekeeping as a means of agricultural diversification and supplementary income generation. Haryana produced approximately 5.60 thousand tonnes (5,600 tonnes) of honey during 2022-23, according to Government of India estimates. More recently, the Haryana Government reported that the state currently produces around 5,000 tonnes of honey and has set a target of 15,500 tonnes by 2030 under its beekeeping policy. The state also aims to increase the number of beekeepers to 7,750. Thus, the development of apiculture in Haryana has considerable significance for increasing farm income, generating rural employment, promoting crop pollination and supporting agricultural diversification. The relatively low land requirement and compatibility with existing farming activities make apiculture particularly suitable as a component of integrated farming systems.

Poultry farming is one of the fastest-growing components of the livestock sector and includes the scientific rearing of chickens, ducks, turkeys and other domesticated birds for the production of eggs and meat. Poultry farming has become an important source of high-quality animal protein, employment and income. Its relatively short production cycle, rapid turnover of capital and increasing consumer demand have contributed to the expansion of the poultry industry worldwide. At the global level, poultry production has expanded considerably due to rising population, urbanization, increasing incomes and growing demand for relatively affordable animal protein. FAO reported that world egg production reached about 100 million tonnes in 2024, of which approximately 94 per cent was hen eggs.

Global meat production reached 374 million tonnes in 2024, with chicken meat being one of the three most-produced meat commodities worldwide. India is among the leading countries in global poultry production. In India, poultry farming has developed from a predominantly backyard activity into a commercially organized industry involving breeding, hatcheries, feed manufacturing, broiler production, layer farming, processing and marketing. According to the Basic Animal Husbandry Statistics (BAHS) 2025, India's total egg production increased to 149.11 billion eggs in 2024-25, making India the second-largest egg-producing country in the world. Commercial poultry accounted for 84.49 per cent of total egg production, while backyard poultry contributed 15.51 per cent. India's poultry meat production has also increased substantially. Total meat production in the country reached 10.50 million tonnes in 2024-25, of which poultry contributed approximately 5.18 million tonnes, accounting for nearly half of total meat production. India ranked fourth globally in total meat production according to the latest Government of India statistics. Haryana is one of the important poultry-producing states of northern India because of its developed agricultural infrastructure, availability of feed ingredients, proximity to major consumption centres and established commercial poultry enterprises. According to BAHS 2025, Haryana produced 91,355.82 lakh eggs (9.14 billion eggs) during 2024-25, compared with 85,595.79 lakh eggs (8.56 billion eggs) during 2023-24.

Materials and Methods

The Cobb-Douglas production function was used for estimating the resources used in major farming systems. $Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6}$

Where,

Y = Dependent Variable (Gross income Rs./ha)

a = Constant

X₁ = Human labour

X₂ = Machinery

X3 = Sugar

X4 = Veterinary charges

X5 = Transportation

X6 = Feed and Supplements

'a' is the constant term and bi's are the regression coefficients to be estimated. Ideally, output (Y) and inputs (Xi's) in the above functional form should be measured in physical units. However, in the present study, monetary values of inputs and output were preferred over their physical quantities.

Analysis of contribution of different factors to gross income

The following form of Cobb-Douglas production function was used to evaluate the resource use efficiency in the production.

The general form of the production function fitted was as follows:

$$Y = aX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}X_5^{b_5}X_6^{b_6}U$$

The above expressed Cobb-Douglas production function was linearized in to a logarithmic function in order to get a practically amenable form and was expressed as below:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + \ln U$$

Where

$\ln$ = Natural logarithm,

a = Constant,

U = Error term

For the calculation of return to scale, Cobb-Douglas production function was used and calculated using formula;

$$RTS = \sum b_i$$

Where

b_i = regression coefficient of i th variable.

The sum of b_i from the Cobb-Douglas production function indicates the nature of return to scale. Return to scale decision rules are:

$RTS < 1$: Decreasing return to scale, (Over-utilization of resources)

$RTS = 1$: Constant return to scale, (Efficient-utilization of resources)

$RTS > 1$: Increasing return to scale. (Under-utilization of resources)

Returns to Scale

Returns to scale are said to be increasing or constant or decreasing, depending on whether proportionate simultaneous increase of input factors results in an increase in output by a greater or same or small proportion. Returns to scale are said to be increasing, constant or decreasing, if it is greater than unity, equal to unity or less than unity, respectively. It is worked out by summing up all production elasticities.

Marginal Value Product

One of the methods of assessing the level of resource use efficiency in agricultural production is by

determining the ratio of the Marginal Value Produced (MVP) to Marginal Factor Cost (MFC). Under this method, the decision rules are that, when; MVP/MFC > 1 , the level of resource use is below the optimum level, implying under- utilization of resources.

MVP/MFC < 1 , the level of resource use is above the optimum level, implying over utilization of resources.

MVP/MFC = 1, the level of resource use is at optimum level, implying efficient utilization of resources.

Where,

MVP = Change in value of output resulting from a unit change in variable input. MFC = price paid for the unit of variable input.

From the above production function the M.V.P. of each resource was worked out. The marginal value and productivity of particular input 'xi' as geometric mean of input and output is expressed in following equation:-

MVP = Marginal Value Productivity

i = Gross value of output (Rs.)

I = factor of production

B_i = Regression coefficient of x_i

P_{xi} = Price of x_i

Results and Discussion

Resource use efficiency of apiculture:

Results are presented in Table 1 which revealed that the coefficients of multiple determinations, R^2 was 0.7553 which indicates that 75.53 per cent variation in apiculture production is explained due to variation in all explanatory variables. The regression coefficient of human labour (0.011) was found positive and significant at 5 per cent level of confidence indicating at 1 per cent increase in human labour cost would increase gross return by 0.01 per cent. On the other hand, the coefficient of transportation (0.187) was found positive and significant at 1 per cent level of confidence. The regression coefficient of sugar (1.043), machine labour (1.112) and sulphur (1.018) were found positive and non-significant.

MVP values of human labor (0.016) and transportation (0.269) were less than one which indicates overutilization of these resources. Hence, by decreasing these resources in apiculture it can increase the returns. MVP value of machine labour (1.901), sugar (2.120) and sulphur (5.990) were found greater than one which indicates underutilization of these resources and there is a scope to enhance the returns by increasing these inputs. In honey production, the regression coefficients of transportation and human labor were found to be positive and significant, while the machine labour, sugar and sulphur were found to be positive and non-significant. Inputs such as human labor and transportation were found to be overutilized, whereas machine labour, sugar and sulphur were

found to be underutilized. Similar results were obtained by Chandra et al. (2017)

Table 1: Resource use efficiency of apiculture in Kurukshetra district of Haryana

Particulars	G M	B	M V P	M F C	r = MVP/ MFC	Resource level
human labour	6.19	0.011**	0.016	1	0.016	Over utilized
machine labour	5.12	1.112	1.901	1	1.901	Under utilized
Sugar	4.30	1.043	2.120	1	2.120	Under utilized
Sulphur	1.49	1.018	5.990	1	5.990	Under utilized
Transportation	6.08	0.187*	0.269	1	0.269	Over utilized
R ²	0.753					

**significant at 5 per cent level, *significant at 1 per cent level

Resource use efficiency of poultry:

Resource use efficiency of poultry farming is presented in Table 2 which indicated that the coefficients of multiple determinations, R² was 0.6304 which indicates that 63.04 per cent variation in poultry production is explained due to variation in all explanatory variables. The regression coefficient of feed or supplements (0.467) was found positive and significant at 5 per cent level of confidence indicating at 1 per cent increase in feed cost would increase gross return by 0.46 per cent. On the other hand, the coefficient of machine labour (1.444) was found positive and non-significant. The regression coefficient of human labour (-3.454), veterinary charges (-4.524) and fuel or electricity (-3.201) were found negative and non-significant.

MVP values of human labour (-0.049), veterinary charges (-15.343), fuel or electricity (-4.985) and feed or supplements (0.514) were less than

one which indicates overutilization of these resources. Hence, if by reducing these resources in poultry it can increase the returns. MVP value of machine labour (2.172) was found greater than one which indicates underutilization of machine labour and there is a scope to enhance the returns by increasing the application of it. In poultry farming, the regression coefficients of machine labor and feed or supplements were found to be positive and significant, while the human labour, veterinary charges and fuel or electricity were found to be negative and non-significant. Inputs such as human labour, spawn and fuel or electricity were found to be overutilized, whereas machine labor was found to be underutilized in the area. These findings are in close conformity with the results of Pawariya and Jheeba (2015)

Table 2: Resource use efficiency of poultry in Kurukshetra district of Haryana

Particulars	G M	B	M V P	M F C	r = MVP/ MFC	Resource level
Human labour	10.65	-3.454	-4.524	1	-4.524	Over utilized
Machine labour	9.28	1.444	2.172	1	2.172	Under utilized
Veterinary charges	10.12	-11.128	-15.343	1	-15.343	Over utilized
Fuel and electricity	8.96	-3.201	-4.985	1	-4.985	Over utilized
Feed and supplements	12.69	0.467**	0.514	1	0.514	Over utilized
R ²	0.6304					

**significant at 5 per cent level, *significant at 1 per cent level

Conclusion

The resource-use efficiency analysis revealed considerable scope for improving the allocation of production resources in both apiculture and poultry farming. In apiculture, the model explained 75.53 per cent of the variation in gross returns, indicating a good explanatory power of the selected production inputs. Human labour and transportation had positive and

significant effects on gross returns but were found to be overutilized based on their MVP values. In contrast, machine labour, sugar and sulphur were underutilized, indicating considerable scope for increasing their application to enhance returns. In poultry farming, the selected explanatory variables explained 63.04 per cent of the variation in gross returns. Expenditure on feed or supplements had a positive and significant effect on gross returns, whereas human labour, veterinary charges and fuel or electricity had negative and non-significant effects. The MVP analysis indicated overutilization of human labour, veterinary charges, fuel or electricity and feed or supplements, while machine labour was underutilized. Overall, the findings suggest that rationalization of input use, reduction in overutilized resources and increased use of underutilized resources can improve resource-use efficiency and profitability in both enterprises. Appropriate extension services, improved farm management practices and better allocation of production inputs may therefore help farmers enhance returns from apiculture and poultry farming.

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